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GPO

$$Emissions\left(\frac{g}{ton-mile}\right)=\frac{1}{payload\,(tons)}\cdot\left(\frac{w_{transient}\cdot m_{transient}}{D_{transient}}+\frac{w_{55}\cdot m_{55}}{D_{55}}+\frac{w_{65}\cdot m_{65}}{D_{65}}\right)$$

Where:

payload = the standard payload, in tons, as specified in § 1037.705.

w = weighting factor for the appropriate test cycle, as described in paragraph (c) of this section.

m = grams of CO_2 emitted over the appropriate test cycle.

D = miles driven over the appropriate test cycle.

(c) Apply weighting factors specific to each type of vehicle and for each duty cycle as described in the following table:

TABLE 1 TO § 1037.510—WEIGHTING FACTORS FOR DUTY CYCLES

	Transient (%)	55 mph cruise (%)	65 mph cruise (%)
Vocational	42	21	37
Vocational Hybrid Vehicles	75	9	16
Day Cabs	19	17	64
Sleeper Cabs	5	9	86

(d) For transient testing, compare actual second-by-second vehicle speed with the speed specified in the test cycle and ensure any differences are consistent with the criteria as specified in 40 CFR part 1066. If the speeds do not conform to these criteria, the test is not valid and must be repeated.

(e) Run test cycles as specified in 40 CFR part 86. For cruise cycle testing of vehicles equipped with cruise control, use the vehicle's cruise control to control the vehicle speed. For vehicles equipped with adjustable VSLs, test the vehicle with the VSL at its highest setting.

(f) Test the vehicle using its adjusted loaded vehicle weight, unless we determine this would be unrepresentative of in-use operation as specified in 40 CFR 1065.10(c)(1).

(g) For hybrid vehicles, correct for the net energy change of the energy storage device as described in 40 CFR 1066.501.

§ 1037.520 Modeling CO_2 emissions to show compliance.

This section describes how to use the Greenhouse gas Emissions Model (GEM) simulation tool (incorporated by reference in § 1037.810) to show compliance with the CO_2 standards of §§ 1037.105 and 1037.106. Use good engineering judgment when demonstrating compliance using the GEM.

(a) *General modeling provisions.* To run the GEM, enter all applicable inputs as specified by the model. All seven of the following inputs apply for sleeper cab tractors, while some do not apply for other regulatory subcategories:

(1) Regulatory subcategory (such as ''Class 8 Combination—Sleeper Cab—High Roof'').

(2) Coefficient of aerodynamic drag, as described in paragraph (b) of this section. Leave this field blank for vocational vehicles.

(3) Steer tire rolling resistance, as described in paragraph (c) of this section.

(4) Drive tire rolling resistance, as described in paragraph (c) of this section.

(5) Vehicle speed limit, as described in paragraph (d) of this section. Leave this field blank for vocational vehicles.

(6) Vehicle weight reduction, as described in paragraph (e) of this section. Leave this field blank for vocational vehicles.

(7) Extended idle reduction credit, as described in paragraph (f) of this section. Leave this field blank for vehicles other than Class 8 sleeper cabs.

(b) *Coefficient of aerodynamic drag and drag area.* Determine the appropriate drag area as follows:

(1) Use the recommended method or an alternate method to establish a

value for the vehicle's drag area, expressed in m^2 and rounded to two decimal places. Where we allow you to group multiple configurations together, measure the drag area of the worst-case configuration. Measure drag areas specified in §1037.521.

(2) Determine the bin level for your vehicle based on the drag area from paragraph (b)(1) of this section as shown in the following tables:

TABLE 1 TO §1037.520—HIGH-ROOF DAY AND SLEEPER CABS

Bin level	If your measured C_DA (m^2) is . . .	Then your C_D input is . . .
High-Roof Day Cabs		
Bin I	≥8.0	0.79
Bin II	7.1–7.9	0.72
Bin III	6.2–7.0	0.63
Bin IV	5.6–6.1	0.56
Bin V	≤5.5	0.51
High-Roof Sleeper Cabs		
Bin I	≥7.6	0.75
Bin II	6.8–7.5	0.68
Bin III	6.3–6.7	0.60
Bin IV	5.6–6.2	0.52
Bin V	≤5.5	0.47

TABLE 2 TO §1037.520— LOW-ROOF DAY AND SLEEPER CABS

Bin level	If your measured C_DA (m^2) is . . .	Then your C_D input is . . .
Low-Roof Day and Sleeper Cabs		
Bin I	≥5.1	0.77
Bin II	≤5.0	0.71
Mid-Roof Day and Sleeper Cabs		
Bin I	≥5.6	0.87
Bin II	≤5.5	0.82

(3) For low- and mid-roof tractors, you may determine your drag area bin based on the drag area bin of an equivalent high-roof tractor. If the high-roof tractor is in Bin I or Bin II, then you may assume your equivalent low- and mid-roof tractors are in Bin I. If the high-roof tractor is in Bin III, Bin IV, or Bin V, then you may assume your equivalent low- and mid-roof tractors are in Bin II.

(c) *Steer and drive tire rolling resistance.* You must have a tire rolling resistance level (TRRL) for each tire configuration. For purposes of this section, you may consider tires with the same SKU number to be the same configuration.

(1) Measure tire rolling resistance in kg per metric ton as specified in ISO 28580 (incorporated by reference in §1037.810), except as specified in this paragraph (c). Use good engineering judgment to ensure that your test results are not biased low. You may ask us to identify a reference test laboratory to which you may correlate your test results. Prior to beginning the test procedure in Section 7 of ISO 28580 for a new bias-ply tire, perform a break-in procedure by running the tire at the specified test speed, load, and pressure for 60±2 minutes.

(2) For each tire design tested, measure rolling resistance of at least three different tires of that specific design and size. Perform the test at least once for each tire. Use the arithmetic mean of these results as your test result. You may use this value as your GEM input or select a higher TRRL. You must test at least one tire size for each tire model, and may use engineering analysis to determine the rolling resistance of other tire sizes of that model. Note that for tire sizes that you do not test, we will treat your analytically derived rolling resistances the same as test results, and we may perform our own testing to verify your values. We may require you to test a small sub-sample of untested tire sizes that we select.

(3) If you obtain your test results from the tire manufacturer or another

third party, you must obtain a signed statement from them verifying the tests were conducted according to the requirements of this part. Such statements are deemed to be submissions to EPA.

(4) For tires marketed as light truck tires and that have load ranges C, D, or E, use as the GEM input TRRL at or above the measured rolling resistance multiplied by 0.87.

(d) *Vehicle speed limit.* If the vehicles will be equipped with a vehicle speed limiter, input the maximum vehicle speed to which the vehicle will be limited (in miles per hour rounded to the nearest 0.1 mile per hour) as specified in §1037.640. Otherwise leave this field blank. Use good engineering judgment to ensure the limiter is tamper resistant. We may require you to obtain preliminary approval for your designs.

(e) *Vehicle weight reduction.* For purposes of this paragraph (e), high-strength steel is steel with tensile strength at or above 350 MPa.

(1) Vehicle weight reduction inputs for wheels are specified relative to dual-wide tires with conventional steel wheels. For purposes of this paragraph (e)(1), a light-weight aluminum wheel is one that weighs at least 21 pounds less than a comparable conventional steel wheel. The inputs are listed in Table 3 to this section. For example, a tractor with aluminum steer wheels and eight (4 × 2) dual-wide aluminum drive wheels would have an input of 210 pounds (2 × 21 + 8 × 21).

TABLE 3 TO §1037.520—WHEEL-RELATED WEIGHT REDUCTIONS

Weight reduction technology	Weight reduction (lb per tire or wheel)
Single-Wide Drive Tire with	
Steel Wheel	84
Aluminum Wheel	139
Light-Weight Aluminum Wheel	147
Steer Tire or Dual-wide Drive Tire with . . .	
High-Strength Steel Wheel	8
Aluminum Wheel	21
Light-Weight Aluminum Wheel	30

(2) Vehicle weight reduction inputs for components other than wheels are specified relative to mild steel components as specified in the following table:

TABLE 4 TO §1037.520—NONWHEEL-RELATED WEIGHT REDUCTIONS

Weight reduction technologies	Aluminum weight reduction (lb)	High-strength steel weight reduction (lb)
Door	20	6
Roof	60	18
Cab rear wall	49	16
Cab floor	56	18
Hood Support Structure System	15	3
Fairing Support Structure System	35	6
Instrument Panel Support Structure	5	1
Brake Drums—Drive (4)	140	11
Brake Drums—Non Drive (2)	60	8
Frame Rails	440	87
Crossmember—Cab	15	5
Crossmember—Suspension	25	6
Crossmember—Non Suspension (3)	15	5
Fifth Wheel	100	25
Radiator Support	20	6
Fuel Tank Support Structure	40	12
Steps	35	6
Bumper	33	10
Shackles	10	3
Front Axle	60	15
Suspension Brackets, Hangers	100	30
Transmission Case	50	12
Clutch Housing	40	10
Drive Axle Hubs (8)	160	4
Non Drive Front Hubs (2)	40	5
Driveshaft	20	5
Transmission/Clutch Shift Levers	20	4

(3) You may ask to apply the innovative technology provisions of §1037.610 for weight reductions not covered by this paragraph (e).

(f) *Extended idle reduction credit.* If your tractor is equipped with idle reduction technology meeting the requirements of §1037.660 that will automatically shut off the main engine after 300 seconds or less, use 5.0 g/ton-mile as the input (or a lesser value specified in §1037.660). Otherwise leave this field blank.

[76 FR 57398, Sept. 15, 2011, as amended at 78 FR 36392, June 17, 2013]

§1037.521 Aerodynamic measurements.

This section describes how to determine the aerodynamic drag area (C_DA) of your vehicle using the coastdown procedure in 40 CFR part 1066 or an alternative method correlated to it.

(a) *General.* The primary method for measuring the aerodynamic drag area of vehicles is specified in paragraph (b) of this section. You may determine the drag area using an alternate method, consistent with the provisions of this section and good engineering judgment, based on wind tunnel testing, computational fluid dynamic modeling, or constant-speed road load testing. See 40 CFR 1068.5 for provisions describing how we may evaluate your engineering judgment. All drag areas measured using an alternative method (C_DA_{alt}) must be adjusted to be equivalent to the corresponding drag areas that would have been measured using the coastdown procedure as follows:

(1) Unless good engineering judgment requires otherwise, assume that coastdown drag areas are proportional to drag areas measured using alternative methods. This means you may apply a single constant adjustment factor ($F_{alt\text{-}aero}$) for a given alternate drag area method using the following equation:

$$C_DA = C_DA_{alt} \times F_{alt\text{-}aero}$$

(2) Determine $F_{alt\text{-}aero}$ by performing coastdown testing and applying your alternate method on the same vehicle. Unless we approve another vehicle, the vehicle must be a Class 8, high-roof, sleeper cab with a full aerodynamics package, pulling a standards trailer. Where you have more than one model meeting these criteria, use the model with the highest projected sales. If you do not have such a model you may use your most comparable model with prior approval. If good engineering judgment allows the use of a single, constant value of $F_{alt\text{-}aero}$, calculate it from this coastdown drag area (C_DA_{coast}) divided by alternative drag area (C_DA_{alt}):

$$F_{alt\text{-}aero} = C_DA_{coast} \div C_DA_{alt}$$

(3) Calculate $F_{alt\text{-}aero}$ to at least three decimal places. For example, if your coastdown testing results in a drag area of 6.430, but your wind tunnel method results in a drag area of 6.200, $F_{alt\text{-}aero}$ would be 1.037.

(b) *Recommended method.* Perform coastdown testing as described in 40 CFR part 1066, subpart D, subject to the following additional provisions:

(1) The specifications of this paragraph (b)(1) apply when measuring drag areas for tractors. Test high-roof tractors with a standard box trailer. Test low- and mid-roof tractors without a trailer (sometimes referred to as in a ''bobtail configuration''). You may test low- and mid-roof tractors with a trailer to evaluate innovative technologies.

(2) The specifications of this paragraph (b)(2) apply for tractors and standard trailers. Use tires mounted on steel rims in a dual configuration (except for steer tires). The tires must—

(i) Be SmartWay-Verified tires or have a rolling resistance below 5.1 kg/ton.

(ii) Have accumulated at least 2,175 miles of prior use but have no less than 50 percent of their original tread depth (as specified for truck cabs in SAE J1263).

(iii) Not be retreads or have any apparent signs of chunking or uneven wear.

(iv) Be size 295/75R22.5 or 275/80R22.5.

(3) Calculate the drag area (C_DA) in m^2 from the coastdown procedure specified in 40 CFR part 1066.

(c) *Approval.* You must obtain preliminary approval before using any methods other than coastdown testing to determine drag coefficients. Send your request for approval to the Designated Compliance Officer. Keep records of the information specified in this paragraph (c). Unless we specify